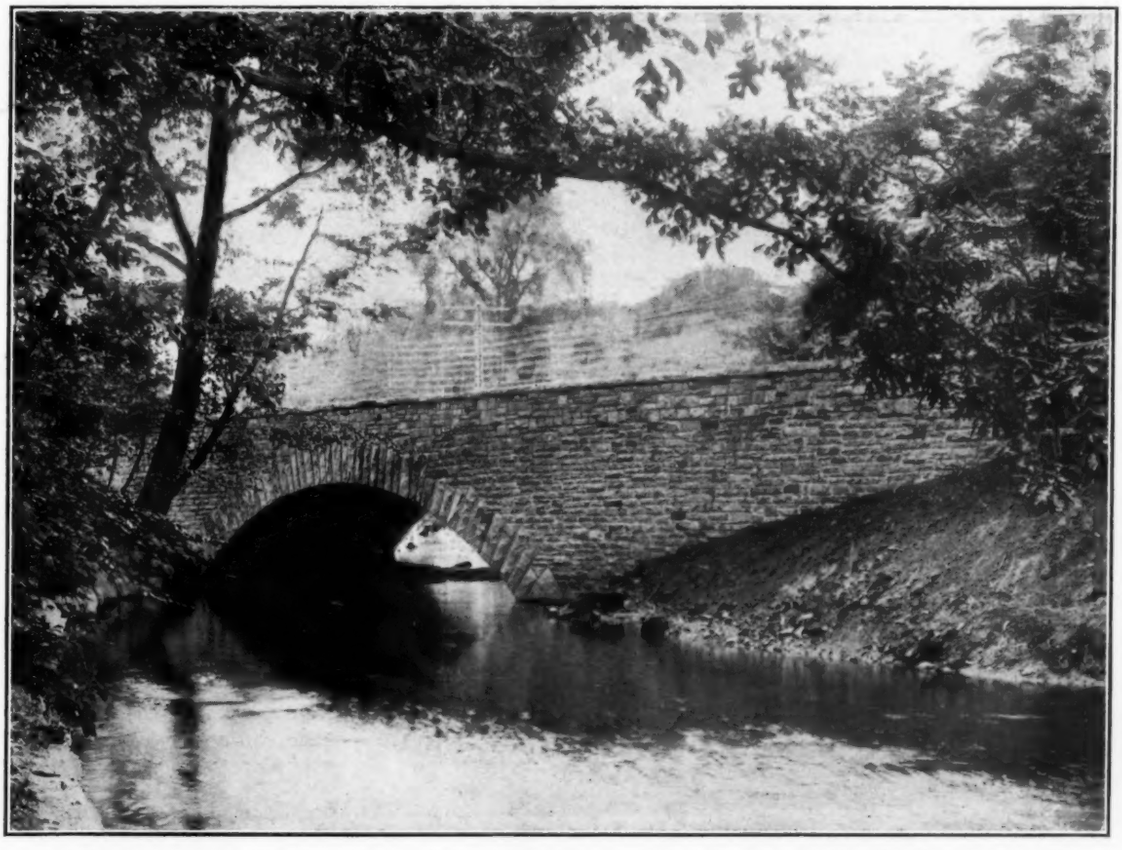
8

PUBLIC WORKS

CITY COUNTY STATE



BRIDGE IN BRONX PARKWAY OF CONCRETE SLAB AND BEAM CONSTRUCTION WITH GRANITE FACING ARCH

IN THIS ISSUE

AUGUST 20, 1921

PUBLIC WORKS.

CITY COUNTY STATE

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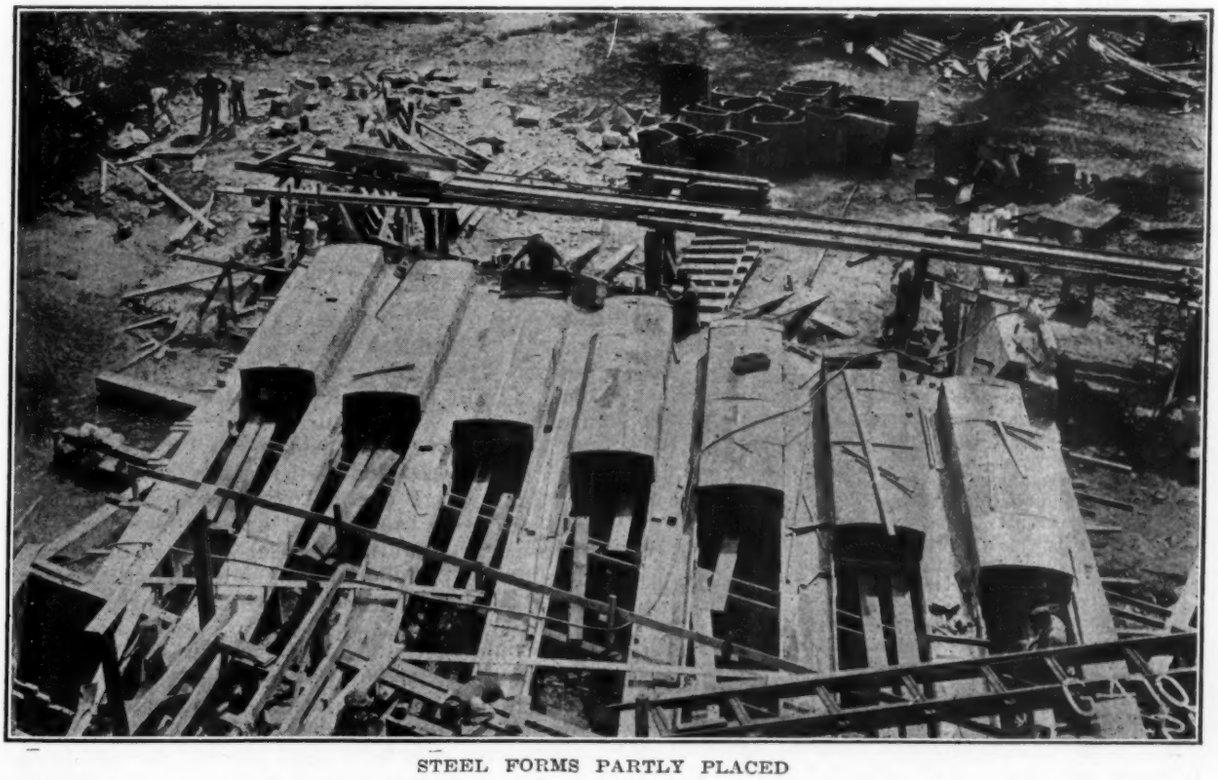
Slab and Beam Bridge With Stone Arch Face

By James Owen*

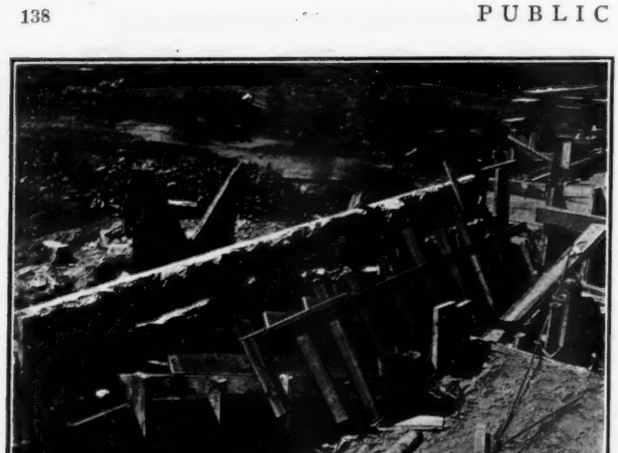
In the Bronx Parkway stone arches were desirable for short-span bridges, but were rendered difficult and expensive by the soft foundation. To meet this condition the engineers designed a concrete slab and beam bridge with a stone arch face giving the appearance of a stone bridge.

A considerable number of small bridges spanning the Bronx river form an important item of development work on the Bronx River Parkway Reservation, which extends from Bronx Botanical Gardens in New York City, a distance of about 15 miles, to Kensico Dam at Valhalla. The development of this parkway is in charge of the Bronx Parkway Commission, consisting of Madison Grant representing the Borough of Manhattan, William W. Niles representing the Borough of the Bronx and Frank H. Bethell representing Westchester county. The work is a joint undertaking of New York City and Westchester county, three-quarters of the expense being met by the city and the balance by the county. An important feature of the parkway development work is a forty-foot driveway which will form a new

*Senior Assistant Engineer, Bronx Park Commission.



STEEL FORMS PARTLY PLACED



APPROACH WALL AND BACKING FORM

motor traffic outlet northward from New York City. The driveway crosses and recrosses the winding course of the river on the bridges above referred to, which are generally from 35 to 50-foot span.

Bridges of the arched type were considered as being generally most suitable. Their architectural treatment has been adapted to the natural surroundings, which are typical of Westchester county's rather rugged landscapes of rocky ridges and woodlands with frequent outcropping ledges. The exterior facings of arch rings, spandrels and approach walls are, therefore, in general, quarry-faced ashlar and rubble masonry of native granite.

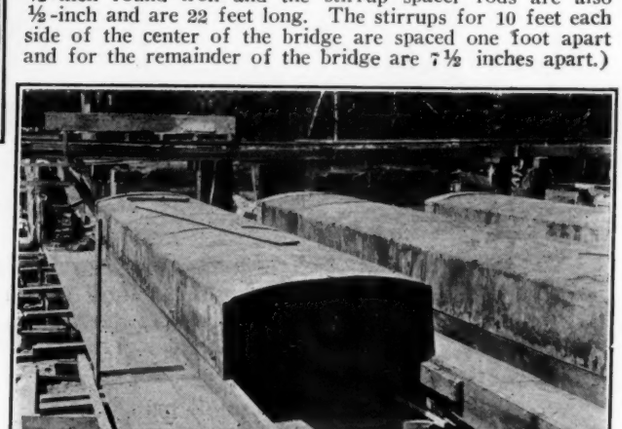
A number of bridges have already been built or are under construction and consists of the customary construction of reinforced concrete arch barrel with exterior stone facing as above described. It is the purpose of this article to describe a different type of construction that has been developed by the engineering department of the Bronx Parkway Commission and applied to bridges now under construction. This improved design consists of reinforced concrete slab and beam, floor or deck construction to carry the roadway instead of a concrete arch barrel, but still retaining the architectural treatment of exterior masonry arch ring and facing walls. The accompanying illustration of Parkway Drive Bridge No. 32 is a good example of the improved type of construction.

(Note: The plans of this bridge show an arch with a 29-foot radius, 40-foot span and 8-foot rise. The bridge has a skew of 36 degrees. This skew, however, affords little difficulty in the construction, as the only part of the structure that needs to be distorted is the under face of the voussoirs of the two cut stone faces. The skew in the slab construction is obtained by the placing of the forms as shown in the photograph. The bridge is 40 feet wide in the clear between parapets. The voussoir stones range from 10 inches to 13 inches in width and are irregular in height, varying from about 2 feet 2 inches to 4 feet. They are laid with stratification radial, beds hammer-dressed and pointed to true surfaces, and rock-faced with projections up to 1½ inches. The 22 stones in the center of the arch are about 1 foot deep measured perpendicular to the face and all others are about 2 feet. The parapet is topped with coping stones 2 feet 2 inches wide and 5 inches thick, and varying in length from 2 feet to 3½ feet, laid with stratification horizontal, top and outside edge rock-faced, laid with ¾-inch joints.

The wooden troughs and steel forms are supported on a falsework consisting of 6 x 6 posts on 6 x 6 sills carrying a 4 x 6 cap on the top of each bent. The bents are placed 8 feet apart in the clear and each bent is knee-braced to a 4 x 6 butt on the under side of the cap. The troughs are supported over each post by two 2 x 4-inch by 1-foot 6-inch wedges.

The bottom of each trough is made of 2-inch tongue and groove plank, 2 feet wide, and this is adjustable as to height by the wedges referred to, rising or falling between the sides, which are fixed in position and are formed of 2 x 10 plank. Resting on the tops of these side planks are the steel forms. The width of the forms and distance between troughs is 4 feet. On the inside of the bottom of each side of each form is a 2-inch angle iron which rests upon the top of the corresponding side plank and is tacked to it.

The main reinforcing rods in the girders are 1⅛-inch round rods, there being 6 to a girder. The stirrups are of ½-inch round iron and the stirrup spacer rods are also ½-inch and are 22 feet long. The stirrups for 10 feet each side of the center of the bridge are spaced one foot apart and for the remainder of the bridge are 7½ inches apart.)



STEEL FORMS AND TROUGHS

The underlying reason for the more economical slab and beam design is that the arch spandrel filling is eliminated, greatly lightening the load and thrust on abutments, with consequent reduction of size of foundation, and in turn a reduction of mass and weight of abutment itself. Even with a material reduction in size and area of foundation, bearing pressures may be kept below the limit where piles would be required in soft ground.

In a bridge of arched design where the character of the ground is such that piling and sheet piling would be required, it is possible by substituting a slab and beam design to so reduce the foundation pressure as to obviate the necessity for piles. On this basis, comparative estimates show that the slab and beam bridge without piles can be built for about six-tenths the cost of the arched type with piling.

Conservative, safe design practice requires an arch to be provided with an unyielding foundation, as a small unequal settlement of abutments will result in cracks and dangerous increase in theoretical computed stresses. On the other hand an abutment supporting a beam construction may settle slightly without such serious results.

The method of construction of a bridge of this type follows the usual procedure of excavation protected by sheeting. Excavation for the approach walls may proceed at the same time as that for main abutments. When the concrete footing courses have been placed, the rubble facing masonry for approach walls is set, and granite

arch rings placed on falsework. The stone facing acts as a form for the approach walls, the backing concrete being bonded to its irregular inside surface. The bonding is made more secure by hooked or Z-shaped steel anchors set between the spaces of stones and projecting into the concrete. At the proper distance behind the stone facing, inclined wooden panels are set to form the back of the wall during concreting.

When the concrete abutments have been brought to the level of the under side of the floor beams, a series of wooden trough forms are set level with the top of the abutments to form the under side of floor beams. These troughs are supported on falsework which is much simpler than the segmental falsework necessary for arch construction. Alternating with the troughs are collapsible steel forms which were used for jack arches in New York City subway construction. The accompanying illustrations show the arrangement of forms which are easily erected whether for straight or skew bridges.

Beams and slabs are reinforced with ordinary types of steel bars and expanded metal reinforcement. Concreting operations for the entire roadway system cover two days' work, half the 40-foot roadway width being placed in one day's run.

Bridges of this type have considerable architectural superiority over many of the concrete structures generally used for highway purposes. With the economical type of construction above described it is possible at small increased expense, to secure a picturesque arched bridge with some

ENDS OF STEEL FORMS SET ON SKEW

architectural merit rather than bald unadorned concrete structures. The latter are of greater strength and durability than the old steel highway bridges they have supplanted, but aesthetically are little or no better.

Tracing briefly the practice of years gone by, in the use of the now nearly obsolete small steel highway bridge, brings out what is perhaps the most important aspect of the economics of the slab and beam concrete bridge with outward appearance of an arch.

The evolution from timber trusses into the steel type swiftly brought keen business competition. Energetic salesmen sold bridges solely on a lowest price basis to officials in remote counties often without competent engineers to protect their interests. These "tin bridges," to use an engineer's appellation, brought the whole breed of steel bridges into such disrepute that one state, noted for its multiplicity of reform measures, actually passed a law forbidding the erection of steel bridges.

A number of recent concrete arch bridge failures has brought to the attention of the engineering profession evidence that these structures have in turn been suffering viccissitudes through efforts to cheapen cost at the expense of safety.

The desire of economy is a very natural one, but competitive cheapening of construction below the requirements of sound engineering practice may result in disaster.

Defective foundations are a prolific cause of failures and it has been alleged by engineers that a favorite means of economy hit upon by administrative officials is the elimination of pile foundations included in the plans.

To summarize on the advantages of the slab and beam construction that has been discussed, it may be said that it provides a structure having the architectural merits and external appearance of an arched bridge but at considerably lower cost without sacrificing safety. By greatly decreasing dead load weights the necessity for piling even in fairly soft ground is avoided, with the accompanying temptation to yield to the delusion that piles may not be needed and the assumption of risks that later lead to failure.

Jacking a Large Culvert Pipe

In order to avoid breaking up the concrete pavements of the Grayson highway in Stanislaus county, California, R. B. Meikle, engineer of the Turlock Irrigation District, installed a 36-inch corrugated steel culvert pipe, 60 feet long, by jacking it through the base of the embankment on which the highway was constructed, without any excavation from above.

The pipe was made up of 3-foot sections, the first of which had a 12-inch forward extension reinforced by a circular end rod to form a cutting edge for the driving shoe.

PLACING CONCRETE

The pipe was installed in a trench transverse to the embankment, and was forced under the latter by a 50-ton jack, reacting against timber blocking at the end of the trench. As the pipe penetrated the earth the loose material was washed out with a water jet and when stone or hardpan were encountered they were loosened with a crowbar operated by a man entering the pipe.

After the first section had been driven, a second 20-foot section was riveted to the rear end and both together were pushed forward as the first had been, and the operations repeated with the third section, completing the work in ten days with three men. The pipe was not distorted or otherwise injured, and the work was done at about the same cost as by ordinary open-cut methods, and with the advantage of no interruption to traffic and no injury to the concrete pavement.

Licensing Engineers

On January 4, 1921, a petition was filed in the Massachusetts Legislature by the Boston Chapter of the American Association of Engineers, accompanied by a bill to provide for the registration of professional engineers and land surveyors. This aroused an immediate protest by the Joint Committee on the Licensing of Engineers, consisting of representatives of the Boston Society of Civil Engineers, the Boston sections of the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, American Society of Heating and Ventilating Engineers, American Institute of Mining and Metallurgical Engineers, the Boston Society of Architects, the Boston Society of Landscape Architects and the Boston Chapter of the American Association of Engineers. On January 7, this committee voted "that legislation relative to the registration of architects and engineers by this year's session of the legislature should not be recommended; second, that the Boston Chapter of the American Association of Engineers be requested to withdraw, for this year, its bill filed with the legislature to regulate the practice of the profession of engineering and land surveying."

This report was signed by all of the members of the committee except the representative of the American Association of Engineers. The association did not withdraw its petition and bill and a hearing on the bill was held by the Committee on Mercantile Affairs of the Massachusetts Legislature on February 18, at which hearing only representatives of the American Association of Engineers appeared for the bill and representatives of seven other societies opposed it. Following this hearing, the legislative committee recommended the bill be referred to the next annual session of the legislature, and this recommendation was adopted by the Senate on February 24 and by the House on March 3.

At the hearing, both the form of the bill, which contained many glaring defects and inequalities which were contrary to the spirit of appropriate legislation, and the principle of registration itself, were vigorously opposed and it was made plain to the legislative committee that only a few of either the public or the engineers were at all interested in having the bill passed.

According to the joint committee, the reasons stated in this bill, as in others urged by the American Association of Engineers before various state legislatures, were that they would safeguard life, health and property in the hands of engineers. Professor George F. Swain pointed out that these were at present safeguarded in Massachusetts by competent commissions and engineers through building laws and other special laws requiring official supervision and approval of plans and that no possible method of registering engineers could take the place of these measures or provide safeguards to society more effectively. Public and private interests are better safeguarded, he said, by selecting an engineer on the basis of his professional reputation and work accomplished, than by virtue of his holding a license.

It was demonstrated at the hearing that a person who registered under the proposed bill would be, in the eyes of the law, fully competent to practice every branch of engineering, regardless of the field in which his training or experience had been. Most of the registration laws make no distinction between different fields of engineering activity, although a man registered as an engineer and whose principal knowledge is confined to mechanical engineering is little better qualified than would be a lawyer or a physician to pose as a chemical, electrical or efficiency engineer.

If licenses are issued to men of mediocre or inferior ability, many such would obtain licenses and have the same standing before the public as those of much greater professional attainments and reputation, with the result that public and private interests would suffer from work of inferior quality.

As to reciprocity with other states, one state cannot compel another to recognize engineers registered in the former and the requirements for registration would be much higher in some states than in others, thus defeating mutual reciprocity.

Another argument advanced against registration is the difficulty of defining an engineer, no effort at such definition yet having proved acceptable. "It is a question how laws can be framed to effectively and properly regulate anything that cannot be definitely and comprehensively defined."

Some at least of the registration laws require that applicants for registration be citizens of the United States or of either the United States or Canada, which would make it impossible to employ in this country British, French or other foreign engineers in connection with big undertakings.

The above are the principal arguments advanced by those who opposed the adoption of the bill before the Massachusetts legislature.

Connecticut State Highway Maintenance and Repairs

Organization of State Highway Department. Apportionment of funds of $10,000,000 yearly. Distribution and charges for equipment. Character and cost of classified repairs.

The state of Connecticut is sixty miles wide and about 110 miles long. Its population is 1,200,000 and the assessed valuation is $1,936,473,275. There are about 12,000 miles of highways, 10,400 miles of which are unimproved, 1,600 miles under state control, and only about 75 miles paved with concrete.

This costly and important work will be designed, supervised and maintained by the well-established technical and executive organization of the State Highway Department that has been developed to handle the problems of most efficient, economical and durable construction and maintenance that have been involved in the great changes of requirements and conditions that have arisen in the few years since the introduction of automobiles and the fewer years since their extensive use for heavy trucking. The department has adopted a rational policy of co-operation with Federal and county work tending to constantly improve the entire system, maintain balanced developments, preserve and extend improvements, establish practical and improved standards with flexibility for local conditions that is carried out by a permanent corps of well-trained employees, promoted for merit to secure and reward efficiency unhampered by political interference.

ORGANIZATION OF DEPARTMENT

State Highway Commissioner, Charles J. Bennett.
Deputy Highway Commissioner, Richard L. Saunders, in charge of construction.
Superintendent of Repairs, W. LeRoy Ulrich, who has charge of maintenance.
Chief Clerk or Chief Accountant, Clinton G. Nichols, who has charge of the accounting, bookkeeping, etc., for both branches.

Under the deputy commissioner, who is in effect the chief engineer of the department, comes the drafting room and five division engineers. They operate all the contracts for road construction or reconstruction of contracts are operated by that branch of the department.

The bridge department is under the deputy commissioner, but the construction of bridges comes under the division engineers. Anything in the way of a bridge, from a 12-inch culvert to a $1,500,000 bridge is constructed.

Under the superintendent of repairs, there are eleven supervisors of repairs who carry on the ordinary repair and maintenance of highways through their own forces employed through foremen and sub-foremen under these different supervisors.

The department has the right to condemn property. The law gives the highway commissioner the right to determine the amount or consideration the property is worth, making an offer to the owner, who can take it or not, but the Highway Department can occupy immediately after making the offer and litigate after. The litigation of the department is carried on at the present time by the Attorney-General of the state.

The accounting system takes in the central part of the department which is in Hartford and reaches out into the accounting systems of engineers and supervisors to get their accounts into the books of the department.

There is maintained a testing laboratory in connection with the city of Hartford. The chemist of the city of Hartford is the chemist of the State Highway Department also.

There are eleven districts, each one in charge of a supervisor of repairs. These districts are divided into sections. There is no particular length of road in a section, the size depending upon the character of the road and what one gang can take care of. The average gang is four or five men throughout the year. Ordinarily each gang has a motor truck. The state owned 60 before the United States Army gave any, and there are about 135 or 140 now. The supervisor has entire control of his district. He reports directly to the superintendent. The section foremen have entire charge of the roads in their section and report to the supervisor. The foremen are competent to do all the repairs that are necessary, and are authorized to make repairs by the supervisor, who covers the district once or twice a week. The superintendent of repairs has charge of maintenance work for the entire state. The assistant superintendent of repairs reports directly to the superintendent of repairs and the superintendent reports to the commissioner.

BUDGET

Automobile receipts, from which the funds of the department are largely derived, come in little by little, right through the year, the bulk coming in January and February, probably over 60 per cent, as most all of the cars are registered in January.

The cost of all maintenance is estimated in advance, based on the figures for the four or five years preceding. The state is divided into eleven districts, and each district is divided into sections, depending upon the topography of the country and the class of roads in that section. The

figures for the preceding years and the conditions of the roads are used each year as a basis for estimating the requirements necessary for each town for the coming year. What it will cost for ordinary maintenance; cost for oiling; cost for state aid work, etc.

These are prepared in the form of allotments to each supervisor in charge of a district; he is sent an allotment, and keeps track of it. It is practically a daily inventory proposition.

The supervisor in charge of any district knows how much money he has left in a certain town. He can tell how much he figures he will have to spend each month to keep the roads in repair, and if any extraordinary work has to be done, he will cut down on his expenses for a later month. Each man knows exactly how much money he has to spend when he starts in and must cut his cloth accordingly. The year is divided into twelve months, and the approximate percentage spent during the year by months is shown on the attached chart.

EQUIPMENT

On gravel roads, drags, calcium spreaders and all miscellaneous small tools, such as hoes, picks, shovels, etc., are used. For the bituminous surfaced road, there are tar kettles, and all the larger equipment which in what is called "various account," is held by the state as a whole, and whenever a man needs more than he has, this apparatus is sent to him, and he pays for it while he has it. Take the trucks, for instance. Every day that the man uses the truck he pays the state of Connecticut a fixed charge. Against the truck is charged the driver, oil, gas and all supplies. If he earns money for the truck, he sends the department a check; if he loses money, the department sends him a check to pay his bills. The district supervisor rents trucks from the state of Connecticut just the same as from an outside party. The per diem charges are $14, $16, $18 and $25 for 1, 1½, 2 and 3-ton trucks, respectively.

Oiling truck charges are $45 to $50 a day. These work a short season and are expensive trucks. Ordinarily the men come out creditors in renting these trucks. The earnings of the truck with its estimated value are indicated on a chart. The majority of them show a profit. If any trucks fall materially below the profit line, they are investigated and the trouble is corrected before the trucks are withdrawn. Every item is kept track of excepting interest on the investment.

The storage plant at Portland, Conn., is centrally located and maintains all of the equipment required for maintenance excepting what is permanently furnished to the different districts. There are there a number of trucks, a steam roller, one or two loaders, pipe, lumber and all kinds of tools and automobile parts. Five or six men are employed there, some carpenters and other mechanics. They build bodies for trucks, etc.

CHARACTER OF REPAIRS

The principal repairs necessary on the surface of the concrete road are the tarring of joints. Of course, the shoulders, railings and culverts on the concrete road require the same repairing as any other road, and take the same amount of work. Approximately $350 per mile is the ordinary cost for repairing concrete roads, and for the concrete surface alone at least $100.

For mixed bituminous roads, including sheet asphalt, Topeka and Warrenite, the repair figures vary with the traffic. On certain parts of the Post road the cost will run up to $3,000 or $4,000 on account of the excessive traffic and lack of foundation, the road being built on an old macadam road. In other sections where there is a concrete base with mixed bituminous top, it will probably average $500 or $600 per year; $500 is the minimum charge for repairs on a bituminous macadam road.

BITUMINOUS ROADS

A portable plant is used where the patches are made by force account, but there is so much of this work that a great deal of it is done by contract.

STATE OF CONNECTICUT
Highway Department

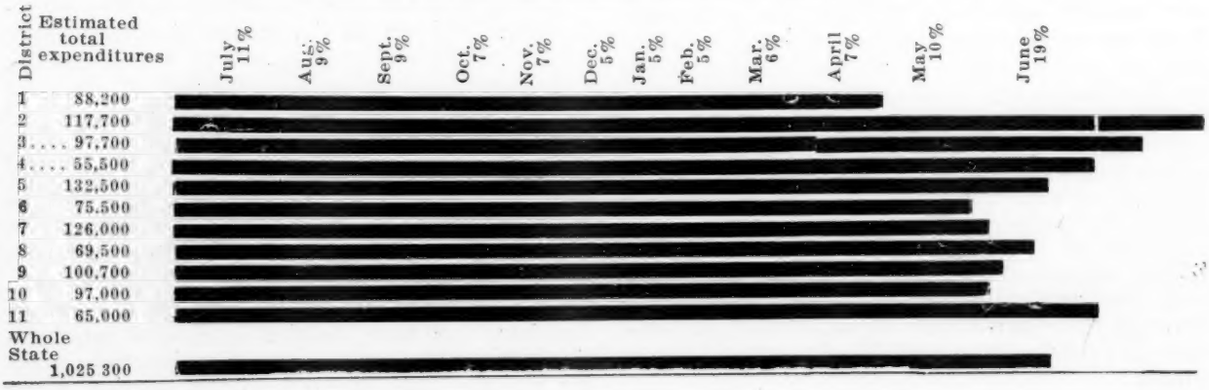
EXPENDITURE CHART

Trunk Line Repairs Ordinary

For Period Ending April 30, 1921

1920-21

W. LeRoy Ulrich, Supt. of Repairs — Charles J. Bennett, Highway Comr.



The patch is cut out square and the hole is filled with the same material as in the original road, which is placed hot and rolled.

The state owns and maintains an asphalt plant, which gets out 60 to 70 tons a day, but it buys the majority of the material, which is easily available at a great many sources, including commercial plants at Hartford, Meriden, New Haven, Bridgeport and Stamford.

WATERBOUND MACADAM

The entire cost of repairing will run from $1,000 to $2,000 a mile, depending on the condition of the road itself, how old it is, and how it was originally built. Sixty per cent of the state system is macadam road.

GRAVEL

Gravel roads will run from $750 to $1,200 per mile per year. They are a little less expensive to maintain than macadam, but do not present as good a riding surface the year round. For nine months of the year they are as good as macadam, and they are cheaper to build in the first place. but will not stand up under traffic. The state is building practically none at this time.

About 10 per cent of the system are dirt roads. One section of eleven miles, along the Connecticut river, costs $2,000 a mile to maintain. This is a trunk line with heavy summer traffic. In other places, where traffic is light, the upkeep costs very little. On the River road, however, it is a case of continual dragging, the traffic being very heavy from Saturday morning until Monday night.

The regular road maintenance includes the removal of snow for the full width of trunk lines, and, afterwards, from state aid lines.

CLASSIFICATIONS OF AMOUNT AND COST OF REPAIR WORK

A record of state aid repair work from July 1, 1919, to June 30, 1920, that was done in 168 towns, comprised 164 miles grading, 139.16 miles gravel, 30.01 miles stone surface, 237.27 miles macadam, 42.61 miles bituminous macadam, 7.98 miles bituminous concrete, 23.05 miles concrete, 0.78 miles brick and granite blocks, making a total of 581.41 miles at an ordinary cost of $306,345.05; extraordinary cost of $94,287.08, and a total expenditure of $279,749.89. Of this sum there were refunds and adjustments amounting to $810.74, leaving a net expenditure of $278,939.15, exclusive of the state oiling, $121,992.18, making a total net cost of $400,932.13. The ordinary repairs amounted to $24,227.85 and the maintenance to $282,417.20.

For the same 168 towns the trunk line repairs during the same period amounted to 99.70 miles graded, 209.39 miles gravel, 48.40 miles stone surface, 393.43 miles macadam, 40.46 miles bituminous macadam, 107.56 miles bituminous concrete, 76.18 miles concrete and 0.88 miles brick, wood block and granite block pavement, making a total of 975.95 miles repaired at an ordinary cost of $1,070,203.97; compensating payments $44,879.61 and accident payments $206.18. The extraordinary costs were $64,955.62, the state aid oiling was $121,992.98 and the total expenditures, including compensation payments, accident payments, and $341,784.85 for supervision and equipment. amounted to $2,287,607.49.

Hackettstown-Budd Lake Highway

Extensive equipment for the construction of a $700,000 section of concrete highway 6.6 miles long through very rough country with young men under guard from Rahway Reformatory that give excellent satisfaction

Section 2, Route 5, of the New Jersey State Road System is 6.6 miles long and extends from Hackettstown to Budd lake, through a very rough country where all but half a mile is in a new location, much of it terraced out of the hillsides and having many 6-degree curves and some grades up to 6 per cent. The line crosses several bad swamps and runs through considerable heavy timber that necessitated clearing and grubbing 17 acres. The road has a concrete pavement 20 feet wide, from 6 to 8½ inches thick, crowned 2½ inches and made of 1:2:4 concrete placed directly, without other foundation, on subgrade compacted and finished to within ¼ inch of the required level.

QUANTITIES AND STATE LABOR

The principal quantities involved are 59,500 yards of excavation, including 6,000 yards of rock, 31,000 yards of extra embankment, 74,211 square yards of concrete, 5,000 square yards of cobble paved gutter, 4,000 linear feet of reinforced concrete culvert pipe from 12 to 30 inches in diameter, 1,000 feet of 6-inch vitrified French drain pipe, 20,000 linear feet of wood guard rail, and eight concrete arch bridges of from 10 to 30 feet span. The estimated cost of the work, exclusive of the bridges, is $700,000. It is being executed by the New Jersey State Highway Commission under the direction of T. J. Wasser, State Highway Engineer.

The work is being executed with equipment owned by the state, a part of which was recently turned over to the commission by the War Department of the United States. Most of the labor is provided by 100 young men under 21 years of age, detailed from the Rahway .Reformatory, who are under constant supervision by keepers who maintain excellent discipline. The men are willing, cheerful and contented, do very good work, and are considered satisfactory and much superior to ordinary convict labor. There are also 4 foremen, 3 mechanics, 12 truck drivers and 26 paid laborers, mostly employed on the steam shovel work.

The grading is heavy and difficult and includes a great deal of boulder excavation, where many of the boulders have to be block drilled and blasted and when the stones are so numerous and have so little soil between them that it has been necessary to draw on extra earth to fill up to subgrade. The excavation is mostly steam shovel work, much of the spoil being cast alongside and downhill by the shovel and not requiring transportation, although in some cases excess of em-

bankment requires earth to be dug from borrow pits and hauled up to the fill.

On July 15, 30,000 yards of excavation had been completed and about 16,000 square yards of concreting, and had attained a regular progress of about 260 linear feet per day.

STORING, MEASURING AND TRANSPORTING AGGREGATE

Storage for 800 yards of aggregate is provided for at headquarters, where a side hill has been cut to a vertical face and retained by crib work 20 feet high, on which a branch road is located, permitting automobile trucks to bring sand and gravel and dump them from the top of the cribbing to surface storage piles, whence they are reclaimed by ¾-yard clamshell buckets operated by a 66-foot derrick boom that fills the elevated storage bin of 50 tons combined stone and sand capacity. There are 60 steel bottom-flap batch boxes of 27 cubic feet capacity, that are placed on flat cars under the storage bins and filled up to a certain mark with sand, gravel and cement, hauled, in 10-car trains, by Plymouth gasoline locomotives and delivered to the Koehring 1-yard mixer.

The 24-inch service track running the full length of the road, is laid with 25-pound rails spiked to wooden ties and has ten 300-foot sidings, long enough to accommodate two 10-car trains. It is thus intended to maintain continuous operations in concreting with one train of cars being filled at the storage bins, another delivering materials to the concrete mixer, one train being hauled to the mixer and one train returning or side-tracked to pass the full train.

Cement in bags is stored in a 16 x 60-foot house having a capacity of 10 carloads. Reinforcement which consists of galvanized American wire mesh is received in rolls 4 feet wide that are stored under cover and before use are flattened by passing through a set of straightening machines similar to boiler makers' rolls, being rapidly pulled through by a tackle operated by a gasoline engine and thus straightening the fabric at the rate of about 200 squares per hour.

Excavating is done with two ¾-yard steam shovels served by nine 5-ton White automobile dump trucks making an average haul of 1 mile.

PLANT AND BUILDINGS

Besides the items already mentioned, the principal articles of equipment include 62 flat cars, one 12-ton Buffalo-Pitts roller, one 5-ton International tractor hauling a Champion blade scraper, 5 Syracuse plows, 4 Syracuse rooters, three 350-gallon centrifugal pumps, besides plunger pumps, 5 Foos and Novo force pumps, all with 2-inch discharge pipes supplied from convenient ponds and creeks and pumping into a main line 5 miles long that is equipped with relief valves set to maintain a maximum working pressure of about 50 pounds. There is also 1 steam and gasoline pump for unwatering bridge foundations and two well pumps to provide the camp supply, which is stored in a 3,000-gallon wooden tank on top of a wooden tower 8 feet high.

There is a Koehring ½-yard and a Little Wonder ½-yard mixer for bridge and culvert concrete, and there are ten team-drawn dump wagons and three 3-ton motor trucks with cargo bodies.

The 14 x 20-foot stock room is filled with general supplies and the 16 x 20-foot office accommodates the desk and books of the cost clerk and time-keeper.

There is a 16 x 16-foot engineers' office and a magazine, where there is maintained a supply of about 500 pounds of 40 per cent dynamite in 1-pound sticks replenished every week or two as required.

The camp contains 6 acres, has a 34 x 144-foot one-story wooden dormitory building, furnished with 100 steel cots, and adjoining it is a 16 x 20-foot lavatory with wash trough, basins, showers and water closets. The camp has a complete sewerage system with a 7-foot septic tank and two 100 x 100-foot filter beds used alternate days.

The 34 x 34-foot mess hall seats 100 and is served by a kitchen at the end of the 24 x 96-foot guard building that also contains a guard dining room for 25 men and general sleeping quarters, and the office for the chief of the reformatory deputies. This building is supplemented by a 10 x 10-foot extension containing toilets, shower baths and wash basins.

There is a 27 x 100-foot truck shed with 10 stalls and a 27 x 27-foot garage for the two Ford passenger cars and a motorcycle and the repair and supply room.

There is a 15 x 15-foot smith shop and a 15 x 15-foot oil house containing about 200 gallons of lubricating oil and a 560-gallon underground gasoline tank.

Shifting a Dump Track

At the plant of the U. S. Portland Cement Co., near Davenport, Iowa, there has been made a shallow fill with quarry waste delivered to the site in 6-yard side dump cars, hauled by a locomotive. As fast as the face of the dump advanced, the ties were jacked up above the surface and the track was bodily hauled transversely to the edge of the fill by a stump puller, operating two lines attached to the track and to a parallel anchored cable secured to deadmen 50 feet apart and affording connections at any point to suit the requirements of the track shifting. The anchored cable served for a long time in one position for most rapid and convenient attachment and the methods employed saved considerable labor.

A Hoisting Tower Water Tank

The head works of a colliery at Liegé, Belgium, has been utilized for the support of an elevated reinforced concrete water tank of 9,000 gallons capacity, which is reported to have been built at a cost of only about $300 above what the cost of the tower itself would have been without the tank. The tank is ornamented with pilasters and Gothic arches in the facades, has a crenelated parapet, and little minarets at each corner, giving it an attractive appearance. No further data are given so the inference is that the tank was constructed with the hoisting tower and to provide water for colliery purposes.

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Arch Faces for Slab and Beam Bridges

Where any regard is had for appearances in planning public improvements and their surroundings, and especially in parks, every effort is made to utilize to the utmost any streams or other bodies of water as attractive features of the landscape. Consequently in such locations the bridges should be carefully designed with a view to artistic lines and appropriateness to surroundings. Under most conditions nothing has been found that equals the arch for beauty of lines, while rough stone harmonizes with rustic surroundings better than any other materials, although dressed stone or concrete may be more appropriate for situations where all the surroundings are artificial.

An arch bridge, however, requires natural or artificial foundations capable of receiving both vertical load and arch thrust with no appreciable yielding; and if the soil be soft and deep, this involves considerable expense for piles or other foundations, and unless experienced enginers prepare the plans there remains even then the possibility that the bridge may fail.

Such a soil condition was found along the Bronx river by the Bronx Parkway Commission, and its engineers, after studying the problem carefully, decided to bridge the river with concrete slab and beam construction, resting on end abutments with all pressures vertical, and build on each side of the bridge a face of stone masonry in the form of an arch. The resulting appearance is shown by the photograph on the front cover of this issue. While close inspection shows the vertical abutments between the two thin arch walls, at a distance this is not noticeable and the effect is very pleasing; much more so, certainly, than would be that of a slab and beam bridge with its severe straight lines.

It has been said that the introduction into a structure of an arch, pillar or other feature that serves no structural purpose, cannot be used to produce an artistic effect; and some may criticize this design from that point of view. But inasmuch as the arch is the most appropriate structure for a bridge in such a locality, and as the effect produced is most pleasing so long as the real construction is not discovered, the deception would seem to be justified under conditions such as those found in the Bronx Parkway.

Budget System of Highway Maintenance

A complete system of methods, operations, costs and records for the maintenance and repairs of about 1,600 miles of state controlled roads in Connecticut has been thoroughly worked out and is in satisfactory operation. This includes about 175 miles of concrete and bituminous concrete roads, 450 miles of stone and bituminous macadam and the remainder of stone, gravel, and earth or combinations of them, all of which are treated with oil, tar or calcium chloride. During the present year these roads will require an expenditure of about $2,000,000 for maintenance and repairs, exclusive of bridge work, construction and reconstruction.

This work has been systematized so that it is promptly and continuously conducted, intelligently, directly and efficiently executed in such a manner as to prevent serious deterioration, or undue expense, to be justly apportioned to rural, urban and surburban localities in different parts of the state, to be under constant supervision and to be recorded so that conditions and amounts can be quickly determined from inspection, to give classified costs and to maintain them within the available funds.

These results are effected by a system of organization that divides the state into districts that are subdivided into irregular numbers of sections of varying sizes that are constantly patrolled by experienced men who constantly note varying conditions, as fast as repairs are required order them done by competent 4 or 5-men gangs that can do ordinary repaving without special instructions or

supervision under the general direction of the supervisor, who inspects all the roads in his section once or twice a week.

The supervisors report through the assistant superintendent and superintendent to the state commissioner. Daily reports are made and the central department calculates the costs and from those of the preceding year, compared with local conditions and the requirements developed, prepares in the beginning of each year an estimate for the work likely to be needed in each district during the year. On it there is made a pro-rata allotment of the available funds, which are then delivered to each district supervisor, who is expected to direct the work accordingly, making each month of the year conform to its respective share of the allotment, increasing or decreasing them if necessary to secure a final balance. State equipment is issued to the different districts and they are charged per diem rates for its use, and credited with disbursements.

Under this system it has been found that the minimum average annual costs of repairs and maintenance are: For concrete surfaces, $100; for mixed bituminous roads, including asphalt, $500; for waterbound macadam, $1,000; for gravel roads, $750; and for dirt roads under favorable circumstances only a very small sum is required, chiefly for scraping.

The records of this system are valuable factors in designing new reconstruction so as to balance maintenance and interest of construction in a way to secure the lowest final costs for satisfactory roads of different types.

Finances of Municipal Bond Sales

The Philadelphia Bureau of Municipal Research, following the recent sale of bonds by that city, has discussed the disadvantages just now of issuing long-term bonds, as follows:

The sale by the city on July 18 of an issue of $5,000,000 of 50-year 5½ per cent bonds of the city of Philadelphia at 104.139 and accrued interest was undeniably successful. The large premium received; the fact that more than seventy separate bids were submitted, totaling more than three and a half times the amount of the bonds offered by the city; and the fact that three banking syndicates competed at substantial premiums for the entire issue—these and several other facts made the sale one of the most successful that the city has ever had.

Had the city offered these same bonds at 6 per cent interest, instead of at 5½ per cent, the sale would have been vastly more successful. The city would have received about $650,000 in premiums, instead of $206,950; and there undoubtedly would have been a very large increase in the number of bidders and in the total amount of the proposals submitted. Such a sale would have been heralded as a most wonderful demonstration of the high credit of the city and of the desirability of the bonds as an investment.

Let us not be carried away with first impressions. Let us get down to bedrock. Let us see whether this hypothetical sale is a better indication of the credit of the city than was the actual sale. Let us go a step farther and see whether the actual sale is a better barometer of the city's credit than a sale of those same bonds at 5¼ per cent would have been.

The truth of the matter is this: The hypothetical sale of the 6 per cent bonds, the actual sale of the 5½ per cent bonds, and the hypothetical sale of the 5¼ per cent bonds would, in all probability, have measured the city's credit at substantially the same mark. The 5½ per cent bonds were sold by the city to the banking syndicate on a basis of close to 5.27 per cent, and resold by the syndicate on a basis of about 5.19 per cent. In other words, the cost to the city on this $5,000,000 of bonds is 5.27 per cent per year, not 5½ per cent; and the income to the investors is 5.19 per cent per year. Any $5,000,000 of bonds sold at the same time, whether the interest were 6, 5½, 5¼, 5 or some other per cent, would have been taken by bankers and by investors on substantially the same bases, 5.27 per cent and 5.19 per cent, respectively, and would have cost the city about the same rate per year as the 5½ per cent bonds that were sold will cost.

Not for more than forty years has the city floated an issue of bonds bearing so high a rate of interest or costing so high a rate per year. To commit the city to this high cost for so long a time is hardly careful stewardship. Wisdom should have dictated the avoidance of such a costly committal. In anticipation of lower interest rates later on, and of the consequent opportunity to refund the bonds at a lower yearly cost, the city should have reserved the right to redeem them at par at the end of, say, five years, or on any interest date thereafter. Had it done this, of course it would not have received nearly so large a premium, but it would have been in the highly advantageous position of saving hundreds of thousands of dollars of the taxpayers' money within the 50-year period.

For a present premium of $206,950 the city has placed itself in a position whereby its hands are tied and it is prevented from saving many times the value of that sum.

Verily, the city, like Esau, has sold its birthright for a mess of pottage.

July Building

In the 27 northeastern states of this country construction activity in July amounted to $212,491,000, which, according to F. W. Dodge Co.'s review, is 7 per cent less than in June and 4 per cent greater than in July, 1920. In the same territory the construction during the first seven months of the year has amounted to $1,278,747,000, which is 10 per cent greater than the average for the corresponding time of the preceding five years.

In the New England states the building contracts amounted to 28 per cent more than in June, but in New York and part of New Jersey 15 per cent less than in June. In the middle Atlantic states, in the Pittsburgh district and in the central west they were also less than in June, but in the northwest they were 30 per cent greater than in June.

Fall Letting of Highway Contracts*

A plan to increase production and lower overhead.

A vast amount of waste and inefficiency in highway construction, much of it avoidable, is attributed by engineers and contractors engaged in that industry to the present practice of awarding contracts in the spring. The investment in equipment used in Illinois in 1919 is estimated at approximately six million dollars, yet this equipment was able to operate at capacity for but one week during the season. A record of lettings in Iowa over a period of ten years shows that the average date of letting was April 15, and that concrete was poured about a month and a half later. Since a phenomenal development of roads has introduced elaborate specialized equipment and has occasioned a yearly expenditure exceeding the cost of the Panama Canal, the matter of longer seasons is an important consideration.

ILLINOIS' EXPERIENCE IN 1920

In 1919 the first contracts for Illinois roads were awarded early in May, and but little concrete was placed before July. Production steadily increased until October, when the maximum output was reached. One week after reaching the maximum it dropped off rapidly to zero. On account of the late date in arriving at capacity production, only 172 miles of road were built, and about 600 miles were carried over to the following year, uncompleted. The results of that year, however, were radically different. Conditions in 1920 were approximately those existing under fall letting. Very few contracts were let in the spring, and by reason of work carried over constructors were able to begin operation at the first opening of spring. In consequence of this early start, concrete work began in April, two months earlier than in the previous year, and reached a heavy volume by June. During June transportation failed and the lack of materials disrupted the work. Had this not occurred, the indications are that peak production would have been reached in July and continued with slight fluctuations until October.

In spite of the transportation failure, about 350 miles of pavements were laid and but 192 miles left uncompleted. This means that in 1920, when construction companies were able to start early and with well-laid plans, they built 100 per cent more road than in 1919, and did it in spite of the most trying transportation difficulties.

*Excerpt of paper prepared upon request of Herbert Hoover, Secretary of Commerce, by the Research Department of the Associated General Contractors of America.

The customary procedure of most State Highway Departments has been to ask for bids in the spring—often as late as May. The average number of working days in the central states under spring letting has been found to approximate from 110 to 120, and since the fourteen weeks lost contain twenty-five or thirty days on which weather conditions permit work, the seasons might readily be increased 20 per cent.

It is proposed that State Highway Departments call for proposals and award their contracts during the fall. This procedure is desired not only to extend the working season but to develop the possibilities of interseasonal work.

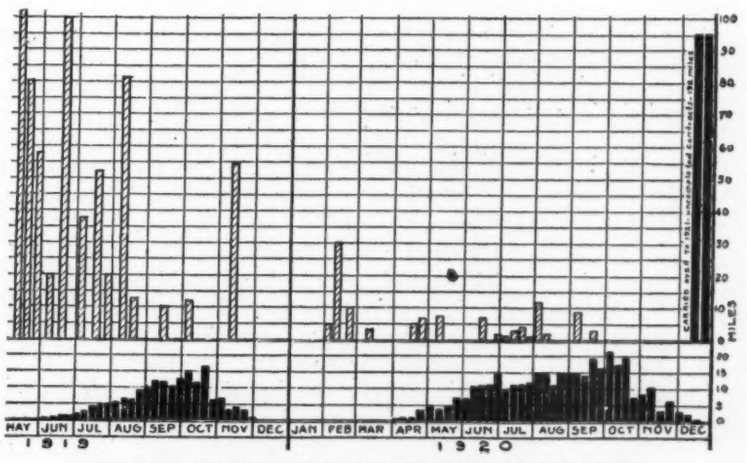
DISADVANTAGES OF FALL LETTING

The objections to fall lettings are: First, in a declining market the state would pay more for work under fall contracts than those awarded the following spring; and, second, the highway departments need a slack season in which to make surveys and plan their projects for the coming year. When prices are practically stabilized this consideration, of course, would not enter and the economies otherwise effected would probably outweigh any minor changes in material prices. The second objection pertaining to the need of highway departments for a slack season in which to plan and make surveys, was not considered serious by the engineers consulted, as they felt that state departments might readily readjust their organizations to handle the work.

ADVANTAGES OF FALL LETTING

The advantages are as follows:

1. Relief of car shortage between July and October.



WEEKLY RECORD OF ROAD PAVING IN ILLINOIS

Upper diagram shows mileage of contracts awarded; the first items being 145 miles, 45 miles beyond limit of diagram. Lower diagram shows completed pavement, 171.1 miles in 1919 and 347 miles in 1920.

2. Employment of labor in slack months.
3. Reduction of seasonal fluctuation in construction.
4. More continuous production of materials.
5. Increased efficiency in road building.
6. Completion of highways as planned by state departments.

RELIEF OF CAR SHORTAGE

Transportation constitutes probably the most difficult item with which road builders have to contend, and if any means is found whereby a steady supply of materials can be assured, great economy will be introduced. Such a means can at least in part be furnished by beginning work early in the spring—thus starting the movement of materials at an early date and reducing the peak demand for open-top cars in late summer. It was this peak demand, contributed to by all industry, which disrupted construction in 1920.

Recent reports from the carriers show that they now have 134,000 cars less than at the transportation peak of 1920. Therefore, it is essential that every industry take action, wherever possible, towards relieving the congestion of late summer. If contracts were awarded in the fall, construction companies could not only give aid in the transportation problem by making certain shipments in winter and spring, but could also give continuous employment to a part of their employees.

SLACK SEASON EMPLOYMENT

On account of the seasonal character of construction, which is one of the most seasonal industries, each year witnesses an enormous fluctuation of activity. In those states which are not favored by a mild climate, an elaborate organization is assembled in the spring and a few months later is scattered as work closes down in the fall.

Any action whereby more continuous employment can be furnished will doubtless draw more competent men into construction and raise the efficiency of those already so engaged

Construction companies could, if awarded contracts before winter, so lay out and execute their preliminary work that winter employment could be given to a considerable number of men. Heavy grading could be carried on, materials could be stock piled to insure a continuous supply, and material distribution plants could be assembled. In this way the preliminary work could be completed before concreting weather arrived, and capacity output could be reached early in the season. Each part of the work that can thus be carried on during the off-season helps to stabilize construction activity.

SEASONAL FLUCTUATION IN CONSTRUCTION

Elimination of the waste in any industry which results from spasmodic or heavy peak demands for production, has for many years been the subject of careful study by public service and other corporations, but until very recently, the same factors in the construction industry have received but scant attention. And yet it is doubtful if any other industry offers a more fruitful field for improvement in peak load inefficiency.

Construction activity in the central and northern states must, on account of climatic conditions, be subject to wide variations. But even in those states the amount of work that can be performed outside of the period now commonly regarded as the construction season, is sufficient to materially reduce the almost feverish activity of late summer and autumn, and by such reduction to affect the economies which arise from more uniform operation.

CONTINUOUS PRODUCTION OF MATERIALS

By lengthening the construction season the operating season for various producers of material is also increased. Two months added in the spring to construction would mean also two months added to the season for producers of gravel, crushed stone, and brick. Their overhead cost would be reduced accordingly and would reflect in the cost of finished roads. Material producers, like construction companies, would be better able to anticipate the market, provide for equipment and lay plans for adequate production.

INCREASED EFFICIENCY IN ROAD BUILDING

Considerable heavy grading can be done between the months of November and April, thus enabling a construction company to retain the nucleus of a permanent field organization. These men could be utilized also at other preliminary work to eliminate much of the dead time in winter during which the permanent field organization draws pay. Another saving can be made in equipment expense. Contractors, upon completion of their work in the fall would not find it necessary to remove their equipment, ship it to the storage yard and then reship it in the spring, but could ship direct to new work. The freight of at least one shipment, and loading expense involved, are in that event eliminated.

Probably the greatest improvement is made possible by the opportunity offered for careful investigation and planning during the slack winter months, and the possibility of retaining a larger number of well-trained men. Any plan whereby construction companies will be enabled to retain mechanics and instruct them over winter will react to increase efficiency.

COMPLETION OF HIGHWAYS PLANNED

The efficiency of a road-building unit, while of interest to the state highway engineers, is not their most vital concern. They are interested first in seeing that the state receives the road which it contracted for and receives it on the date expected. Very few contracts in the last two years have been completed on time. If the conditions of 1920 in Illinois could be approximated in other states, that is, if work could start without the usual delay of spring letting, several contingencies of construction would be avoided, and the various highway departments would doubtless be able to carry out their work as planned. The opinion has been expressed by engineers of the Illinois Division of Highways that, had the material supply not failed it would have been possible with the early start of 1920 to build twice the mileage constructed that year, and build it, moreover, without additional administrative charge and with very little additional overhead

expense to the constructors. The conditions anticipated by engineers and contractors have been so closely verified in Illinois under conditions assimilating fall letting that its advantages are no longer to be doubted.

Highway Notes

During the years 1919 and 1920 the state of Oregon expended $20,000,000 for highway construction, including $1,200,000 Federal Aid money for forest and post roads. Most of the work done was on the Columbia river and the Pacific highways, adding nearly 686 miles of grading, 395 miles of rock and gravel and 363 miles of paving, besides which there are now under contract 300 miles of grading, 250 miles of rock or gravel and about 60 miles of paving.

During 1920 the state of Iowa built 5 miles of steel bridges, nearly 1 mile of concrete bridges, and 62½ miles of culverts, at an aggregate cost of more than $9,000,000.

Expansion of Drawbridge Prevents Closing It

On July 29, following the intense heat that had lasted for several days, the steel draw spans of the Newark turnpike and Lincoln highway over the Hackensack river, New Jersey, were so lengthened by heat expansion that it was found impossible to close them, and one was held open three-quarters of an hour and the other several hours, while an acetylene torch was used to cut off parts of the steel at the points of interference.

Water and Sewers For a Small Town

By W. A. Hardenbergh

Town of fifteen hundred spends $100,0000 for water works, sewerage and sewage treatment. Trenching machines used and rapid progress made.

That a town of 1,500 inhabitants should spend more than $100,000 for construction of water works system and sewers may not be unique, but is interesting as showing what a town of this size can do. The town in question is Maiden, N. C., situated in the Piedmont section of the state, near the foothills of the Blue Ridge. It is an average place—no more prosperous than its neighbors. It contains three small cotton mills, only two of which are served by the new sewer system. As soon as the sewer and water mains have been laid, the streets will be paved, but not at the city's expense, for the state plans to build a hard-surface road through the main street of the town.

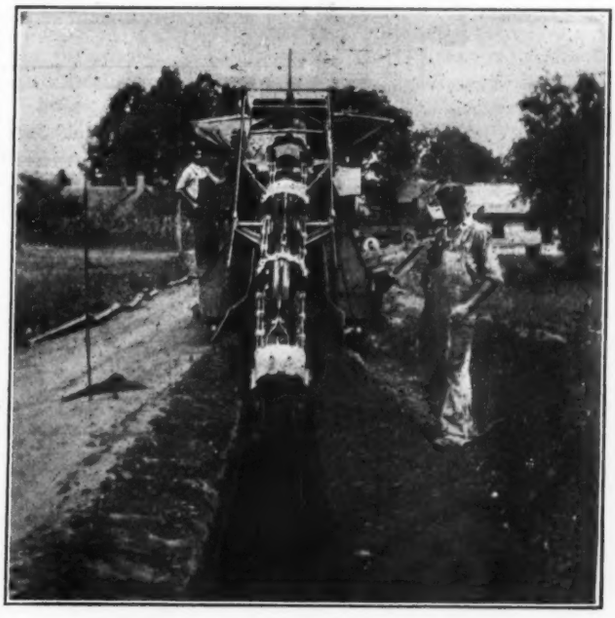
The means adopted for financing the work were not unusual, bonds being voted and sold to the contractor. The work is being pushed with unusual rapidity. Work was begun about the first of May, and the sewers were constructed in less than six weeks and the sewage treatment plants are now under construction, while the water mains were finished in July.

THE WATER SYSTEM

Water is secured from deep wells, the number of which will depend upon the amount of flow per well, which has not yet been determined. The water will be pumped electrically into mains of 1½ inches to 6 inches diameter, of which there will be about 24,000 feet. An elevated tank and tower will provide storage and pressure, the tank being elevated 76 feet and having a capacity of 100,000 gallons. It will give a pressure in the city of about 60 pounds. The cost of the system, including mains, pumps, well, tank, etc., will be about $50,000.

The pipe is laid and caulked entirely by hand. For backfilling, the contractor uses a plank with plow handles fastened thereto and dragged by a single team.

Outside of the rapidity of the work, the most interesting feature of the construction is the use of a ten-year-old Austin trenching machine for doing all the trenching. As high as 2,000 feet of trench 22 inches wide and 36 inches deep were excavated in a day. Outside of this, little attempt was made to use labor-saving machinery, partly because of the smallness of the job, and partly because labor is now fairly plentiful, cheap and efficient. The use of the trenching machine was rendered very desirable by the dry, hard, red clay which it was almost impossible to move by hand.



EXCAVATING TRENCH IN MAIDEN

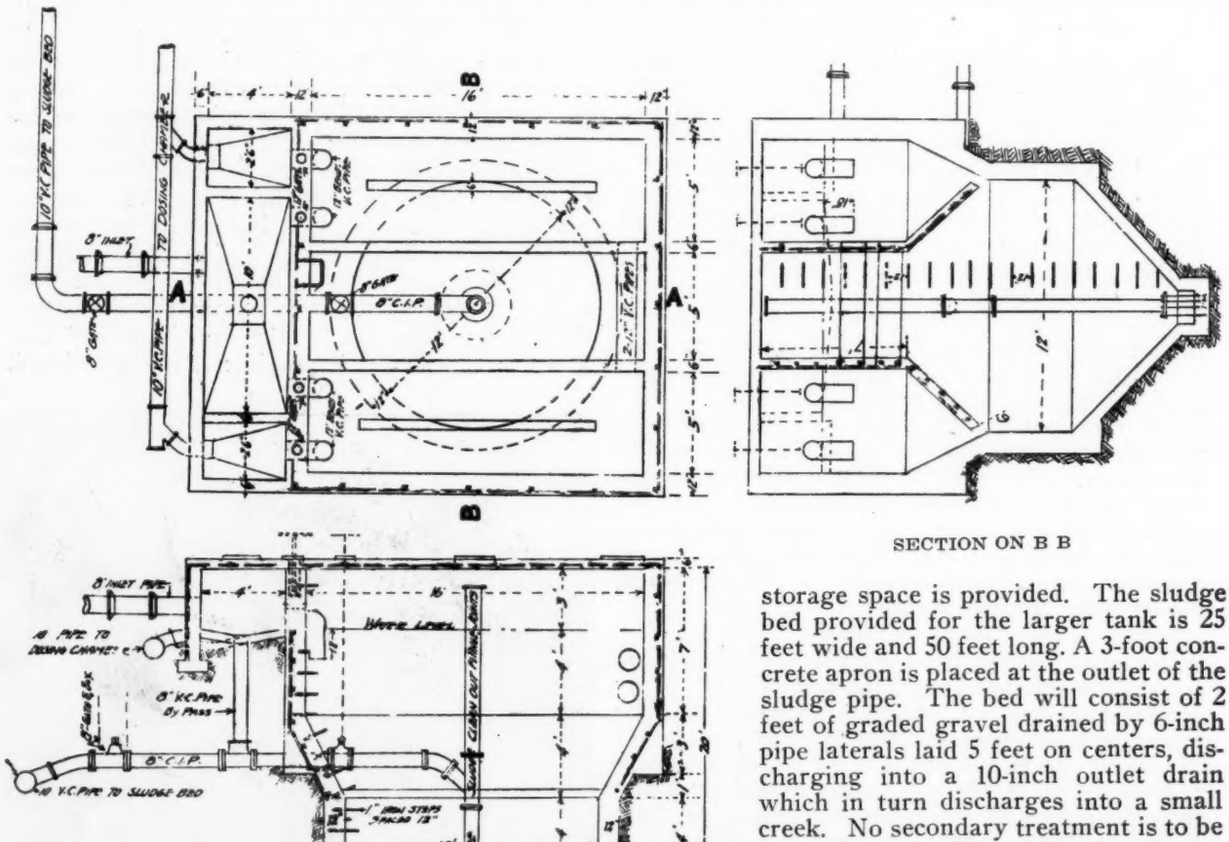
SEWER SYSTEM

Two complete sewer systems were necessary, the town being located on a ridge. No storm water is carried and the sewage is treated in two separate plants. If all the town were sewered, three systems and three disposal plants would be needed, but it was finally decided to omit temporarily one small mill village. About four miles of 6-inch and 8-inch sewer have been laid. All ditching up to 12 feet in depth was done by the Austin trenching machine, but ditches exceeding this depth were finished by hand rather than change the adjustment of the trencher. The deepest trench was about 18 feet. Some rock was encountered and blasted. Where more than 12 feet deep, trenches were timbered. The clay stood while dry almost like rock but became like soft soap and treacherous when wet. The cost of the sewer systems and disposal plants will be about $54,000.

Of the disposal plants, one is about twice the size of the other. These are two-story sedimentation tanks. The smaller one is shown by the accompanying illustration. About 20 feet of excavation was necessary, through a layer of hard, red clay, a thinner layer of black, gravelly clay, followed by mud. A single row of 2 x 8 sheet piling, hand driven, served to retain the banks. A gasoline driven diaphragm pump kept the excavation dry. For mixing the concrete, an Austin half-bag mixer was used, using Lehigh Portland cement with a 1:2:4 mix.

The tanks are peculiar in design in that the lower section is circular while the upper is rectangular. The warping of the circle into the square was a rather difficult piece of form construction. Another peculiarity is that the vent areas total one-third of that of the entire top of the tanks. The tanks are to be covered with a 6-inch concrete top, reinforced with half-inch bars, spaced 12 inches both ways in the large tank, and 12 inches transversely by 24 inches longitudinally in the small tank.

A small chamber is provided at the tank entrance which may be used as a grit chamber, for which a clean-out is provided. From this, the sewage may flow in either direction through either or both halves of the tank. At the end of the tanks opposite the entrance, are equalizing pipes connecting the two settling chambers. The settling chambers allow, with the present load, a retention period of slightly over three hours. Large sludge storage space is provided. The sludge bed provided for the larger tank is 25 feet wide and 50 feet long. A 3-foot concrete apron is placed at the outlet of the sludge pipe. The bed will consist of 2 feet of graded gravel drained by 6-inch pipe laterals laid 5 feet on centers, discharging into a 10-inch outlet drain which in turn discharges into a small creek. No secondary treatment is to be given the tank effluents for the present.



PLAN AND SECTION ON A A

SECTION ON B B

PLAN AND SECTIONS OF SEDIMENTATION TANK

The work is being done by Boyd, Higgins & Goforth, of Charlotte, as contractors, C. D. Goforth at present acting as superintendent of construction. H. K. Setzer is resident engineer for the Carolina Engineering Co., of Wilmington, N. C., who are the consulting engineers for the work.

Construction Questions Answered

Suggestions as to methods, "wrinkles" and appliances that may be used to overcome difficulties arising in construction work. We invite questions concerning such problems that may arise from time to time in the experience of any of our readers. Answers prepared by competent authorities will be published promptly. It is hoped that others who have solved similar problems differently will send us their solutions for publication also; or describe new "wrinkles." If it is only a new way to drive a nail, it may help some one.

How to Handle and Erect Girder Spans Without Special Equipment—IV*

With locomotive cranes, derrick cars and wrecking cars.

Highway girders of any length may, when equipment is available, be very advantageously erected under most ordinary conditions by locomotive cranes, derrick cars and wrecking cars. One or two cranes or cars can handle the girders according to their position and weight.

Locomotive cranes of from 10 to 50 tons capacity with booms 25 to 75 feet long are found in the equipment of almost every large general contractor, and may therefore be often available for rental by smaller contractors in the neighborhood who do not possess them. Locomotive cranes are mounted on standard or broad-gauge railroad trucks, on traction wheels with wide flat surfaces, and on caterpillar traction. The first can, of course, be used only where railroad tracks are convenient, the second can be used on any smooth, level highway or on track planks properly laid in advance, even over soft ground, and cranes mounted on caterpillar traction can go almost anywhere, even up steep inclines and over soft or very rough ground, with or without roads.

Certain types of trenching and backfilling machines are substantially equivalent to locomotive cranes and may be used in the same way for bridge erection, but are usually of smaller capacity and therefore only able to handle spans of moderate weight. Generally, however, they are mounted on caterpillar traction and thus have a wide area of availability without the necessity for railroad tracks or the special preparation of roads.

Bridges over, or immediately adjacent to, railroad tracks very often can be erected by the derrick cars owned by the railroads and by the larger bridge contractors, or by the wrecking cars owned by most railroads, provided the owners are willing to rent them at the required time for a reasonable price. Both derrick cars and wrecking cars are built for extremely heavy service and often have capacities up to 100 tons or more. Derrick cars have longer booms than wrecking cars, generally from 30 to 65 feet, and are often provided with a pretty full erection equipment, including air compressor for pneumatic riveting, and are suitable for handling the longest and heaviest girders shipped, for which purpose they are especially designed. The wrecking cars have a much shorter reach, but can handle heavy loads.

All of the above-mentioned equipment serve essentially as moveable boom derricks, and when available are very rapid, convenient and efficient for loading, unloading, shifting and erection into position not only the girders, but also the floor beams, stringers and any other heavy members of the structure. They are also convenient for bringing heavy girders a considerable distance from the storage yards to the site, as is frequently necessary in short intervals when the tracks can be used between trains. In such cases, or for handling the girders at the site when they are very heavy two locomotive cranes or cars may be used, one at each end of the girder with the girder suspended between them on the center line of their

*Part I.—Transportation to site and erecting by steam protrusion was published July 3.
Part II.—Erection by cribbing, jacking, rolling and skidding was published July 30.
Part III.—With fixed and moveable derricks was published August 6.

NEW EAST ROADWAY OF CHELSEA BRIDGE IN SERVICE. OLD WEST TRUSS NOT YET REMOVED

REMOVING OLD CENTER TRUSS OF CHELSEA BRIDGE

NEW SPAN DELIVERED AT OLD BRIDGE OVER WELLS RIVER, VT.

track or offset a short distance from it by swinging the booms, but great care must be taken in the latter case not to swing the girder far enough to threaten the stability of the cars or locomotive cranes, which are easily overturned with little warning when the moment becomes too great.

The bridge at Deal Lake, Asbury Park, N. J., consisted of fifteen 42-foot plate girder highway spans, each girder weighing a little less than 10 tons. They replaced old lattice girder spans on the same substructure that were removed by a derrick car, consisting of a stiff-leg wooden derrick with hoisting engine and steam boiler mounted on a flat car, a device that may readily be improvised by any contractor. As the successive girders were removed and lowered to the bottom in the shallow water alongside the pier the same derrick car set the plate girders in place, advancing from span to span as the work progressed and thus permitting the steel work to be rapidly assembled ready for completion by the field riveters.

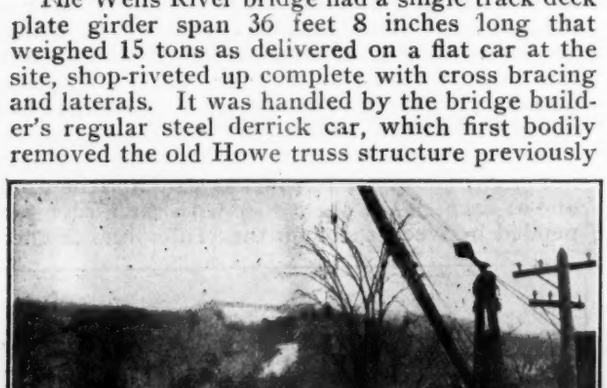
The plate girder bridge at Wells River, Vt., although for railroad traffic, corresponded in general type to heavy street bridges and the method of handling it would suffice for the latter wherever locomotive cranes, derrick cars or their equivalent could be readily obtained.

The Wells River bridge had a single track deck plate girder span 36 feet 8 inches long that weighed 15 tons as delivered on a flat car at the site, shop-riveted up complete with cross bracing and laterals. It was handled by the bridge builder's regular steel derrick car, which first bodily removed the old Howe truss structure previously carrying the railroad track across the highway. Having lifted the trusses and floor system entire by means of bridles attached to the lower chords at panel points, the car removed it a short distance away from the crossing, deposited the old superstructure on the ground, returned to the flat car on which the new plate girder span was received, unloaded it, carried it to the site and swung it to position by practically continuous operations, thus completing the replacement of the superstructure with a minimum of delay or hand labor.

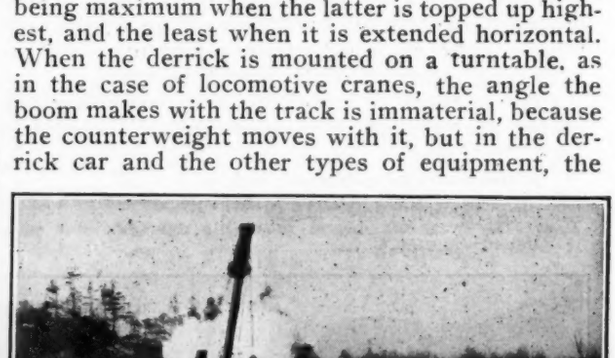
The highway bridge over the railroad tracks at Chelsea, Mass., was originally constructed with three wooden Howe trusses that were replaced without interrupting traffic by a 130-ton steel span with five main girders from about 76 to 84 feet in length. The replacement of the old superstructure by the new one on the old substructure was effected without interrupting the railroad or highway traffic by a heavy standard derrick car belonging to the contractors, the American Bridge Co., which was operated at low level on the regular railroad tracks at intervals between trains.

Traffic being diverted to the west half of the bridge the floor of the east half was removed, the derrick car lifted the old truss from the substructure and carried it away, then returning erected the new center girder and the two side girders in their proper positions, assembled the floor beams and bracing to them and the floor was laid, permitting the traffic to be diverted from the west to the east side of the bridge, after which the remainder of the old floor was removed, the derrick car took down the old center and west trusses and erected the remaining two plate girders, the floor beams, and the remaining bracing, enabling the west half of the floor to be laid and completing the new superstructure.

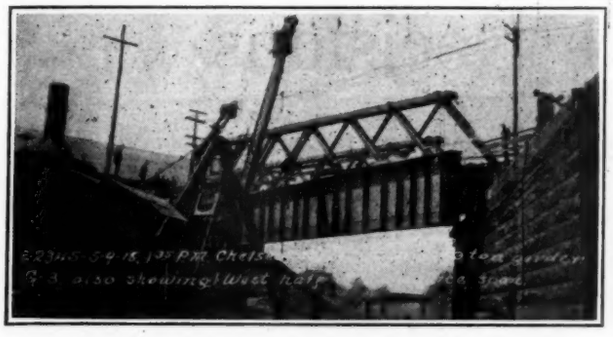
In handling heavy girders with locomotive cranes, derrick cars and other equipment of the same type it must always be remembered that the stability of the derrick is of vital importance and that it varies directly with the height of the boom, being maximum when the latter is topped up highest, and the least when it is extended horizontal. When the derrick is mounted on a turntable, as in the case of locomotive cranes, the angle the boom makes with the track is immaterial, because the counterweight moves with it, but in the derrick car and the other types of equipment, the



ERECTING PLATE GIRDER SPAN COMPLETE AT WELLS RIVER, VT.



DERRICK CAR TRANSPORTING OLD SPAN OF WELLS RIVER BRIDGE TO STOCK YARD



ERECTING 23-TON PLATE GIRDER FROM LOW LEVEL TRACKS

counterweight, usually consisting of the whole car, remains stationary and its stability is least when the boom is at right angles to the track. In nearly all cases the stability can be increased by anchoring the truck or car to the track with clamps, chains or other devices and in special cases extra heavy loads can be handled in the given position by guying or bracing the car or the frame from which the boom is operating.

Eliminating Prohibitory Wages in Dallas

Exorbitant demands of bricklayers, plasterers and plumbers have necessitated a stoppage of building construction. The city subjected to the highest scales reported from many high-priced cities.

For the purpose of bringing about a reduction in wages being paid bricklayers, plasterers and plumbers in Dallas, contracting firms and individuals who have buildings under construction or contemplated were requested by the Chamber of Commerce to cease operations until such time as a reasonable adjustment in the wages of the three crafts mentioned is effected.

A resolution setting forth the views of the chamber was adopted at a meeting which was called at the request of persons engaged in building and also in compliance with the wishes of the General Contractors' Association of Dallas. About 100 business men attended.

According to reports from eighteen principal cities in the country relative to wage scales, the scale for bricklayers is higher in Dallas than in any other city mentioned except Fort Worth and that in the other two crafts the scale is higher in Dallas.

The plumbers have stated individually to their various employers that they would be glad to accept the requested cut of $1 a day, but at their regular meeting on Monday, August 1, the business agent did not allow the question of the reduction to be brought up on the floor.

The present rate of $12 for bricklayers and plasterers and $11 for plumbers has discouraged building and many contracts await assurance of lower wages. During the war the plumbers' pay was increased from $6 to $11 a day and a contract made with the union to maintain it until August 14, 1922, modified by a verbal agreement, now repudiated by the union, to make reductions when conditions approached normal.

At the meeting of contractors all expressed the opinion that the bricklayers' wage of $12 a day is disproportionate to all other trades and other cities and should be reduced to $10 per day or less.

The action of the Dallas Chamber of Commerce is commendable. It is high time that the long-suffering builders and constructors who represent the second largest interest in this country, should be permitted to resume their activities on which the prosperity and progress of the nation depends more than on any other factor, with the possible exception of direct food production.

In the war emergency construction interests were very largely declared non-essential and heavily discriminated against; wherever they were permitted a measure of activity they were saddled with huge handicaps of totally unnecessary and unjustified excess costs of wages initiated and fostered for political purposes, that have proved an almost overwhelming handicap and are still keeping the whole country far behind in the international race for readjustment.

While the whole country has suffered from the waste and derangement of war and the extravagance of post-war conditions, only the profiteers and laborers have escaped its heavy burdens and have actually profited by the adverse conditions and reaped a huge selfish harvest from the necessities and misfortunes of their neighbors.

Now that the whole country has, in effect, gone into liquidation, its merchants, financiers, investors and industries have accepted their losses and reduced prices to a more reasonable level, labor alone insolently demands not only its outrageous extreme price, but in many cases calls for still greater increases, retains a considerable degree of the inefficiency encouraged by war conditions, and in many cases deliberately soldiers on the job in order to prolong the small amount of inevitable work and thus add yet more to the unit costs which, in many cases, are still three or four times as great as the pre-war rates.

It is plain that prosperity cannot be generally attained until wages take their fair share of reduction and labor becomes reliable and efficient. Men or unions that are demanding steep prices when their necessities are reduced at the price of great loss and business depression should be summarily dealt with and if it needs a long breadline and stern measures to convince them, the sooner they are attained the better. It is to be sincerely hoped that in every place where wages are disproportionate and where labor is not amenable to reasonable and honest arrangement, measures will be taken similar to those in Dallas, and all construction stopped short until a satisfactory basis can be established and maintained.

A 90-ton Marion steam shovel in a quarry at Carlton, Cal., has special safety equipment. The boom gears are enclosed by removable sheet iron guards; stairways on each side of the boom give access to all parts of it when in operation, and, like the runways and openings on the sides of the cab, are protected by handrails, so that all the fast-moving and hazardous machinery is inaccessible to personal contact. Such precautions not only reduce danger of accidents, but preserve the machine and expedite and increase its work.

Recent Legal Decisions

ESTOPPEL BY DELAY TO OBJECT TO PAVING ASSESSMENT

In an action to have a lien for a paving assessment adjudged invalid, it was held, Johnston v. City of Hartford (Conn.), 113 Atl. 273, that it was the plaintiffs' duty, if they had intended to object to the improvements, to use all means in their power to prevent the making or execution of the contract for paving. This they did not do. They stood by in silence and acquiescence during a year, and permitted the contract to be made, the work to be completed, the assessment laid, and the city's portion of it to be paid, meanwhile retaining all the benefits of the improvement. It was held that the plaintiffs, by their conduct, had estopped themselves from attacking the validity of the assessment and lien.

ORDINANCE AGAINST INCREASING SIZE OF WOODEN BUILDINGS IN CITY HELD REASONABLE

The Maine Supreme Judicial Court holds, City of Lewiston v. Grant, 113 Atl. 181, that an ordinance of the city of Lewiston, adopted pursuant to statutory power, and providing that no wooden building standing on any lot within prescribed limits shall be repaired or altered so as to increase its present height or size, is not unreasonable in its purpose to diminish fire hazard, is clearly within the police powers of a city or town, and is not in conflict with any constitutional provision. "The added height or size of wooden buildings in a congested portion of any city or town may have a material effect upon the danger of extensive conflagrations and the hazard to surrounding property."

CONSTRUCTION OF GUARANTY AS TO MAINTENANCE BY CONTRACTOR IN PAVING CONTRACT

A city sued an asphalt company and its bonding company for damages arising out of a paving contract, in which the contractor guaranteed: "That the pavement laid shall be of such material and with such workmanship that the pavement shall be and remain in good repair and free from all settlements, defects and damages due to the use of defective material and workmanship or the proper use of the street as a roadway or the action of the elements for the full term of ten years," with an additional provision as to the repair of disintegration. This guaranty was substantially repeated in the bond. On appeal from a judgment for the city, the defendants' counsel said that the only question presented was the meaning of the words "or the proper use of the street as a roadway or the action of the elements.' They argued that the contract and bond simply insured the character of the material and workmanship furnished by the company, and that as the trial court found in their favor on these matters they were entitled to prevail. The Kansas Supreme Court holds, City of Leavenworth v. Green River Asphalt Co., 196 Pac. 1091, on the authority of Kansas City v. Hanson, 60 Kan. 833, 58 Pac. 474, that the contract and bond guaranteed the pavement for ten years only as to the character and workmanship furnished by the contractor. The fact that certain repairs were made by the contractors some nine years after the completion of the work did not estop them from maintaining this defense. Judgment for the plaintiff was therefore reversed, with directions to enter judgment for the defendants.

SUIT TO ENJOIN SEWER ASSESSMENT BARRED BY DELAY

The Oklahoma Supreme Court holds, Woodward v. City of Tulsa, 196 Pac. 683, that under section 471, Rev. Laws 1910, an action to enjoin assessments levied to pay certain tax warrants issued for the construction of sewers in the city of Tulsa and to cancel said tax warrants on the ground that the estimates for the work were fraudulently made by the contractor and the city officials, where the city acquired jurisdiction by proper proceedings to construct the sewers, cannot be maintained after the expiration of 60 days from the passage of the ordinance making the final assessment, the period within which the statute provides suit to set aside an assessment must be brought. The estimation of the items making up the different kinds of work done in excavating the sewer, if done incorrectly and fraudulently, was an irregularity and did not go to the jurisdiction of the city in levying the assessment or in issuing the warrants or certificates, and to have been taken advantage of must have been by action brought prior to the expiration of the 60-day period provided in the statute.

TIME FOR PROTEST AS TO MATERIAL USED IN WORK—EVIDENCE AS TO SUFFICIENCY OF MATERIAL

Where road work was inspected from time to time while it was in progress by the county commissioner in whose district the road was situated and who was by law ex-officio road commissioner therein, and no objection was made by him to the character of the material used in the construction, the Washington Supreme Court holds, Brown v. Benton County, 197 Pac. 7, that if materials were to be protested good faith required that the protest be made at the time of the inspection.

The evidence in the case, which was against the county for balance due on the contract, was held by no means convincing that the material used for binding purposes was defective or unsatisfactory in the sense that it would under no circumstances serve the purpose for which it was intended. Both the contractor and the engineer testified that it was as good as any that could be obtained in the vicinity of the road, and fully equal to that which the county afterwards caused to be placed thereon. They stated that it did not pack firmly under traffic without sufficient moisture; and that the county secured a better result because they applied it at a more favorable season. Judgment for the plaintiff was affirmed.

NEWS OF THE SOCIETIES

Aug. 23-25—AMERICAN ASSOCIATION OF PARK SUPERINTENDENTS Annual meeting. Detroit, Mich. Secretary, Emmet P. Griffin, Superintendent of Park, East St. Louis, Ill.

August 29-30—INDIANA BUILDING TRADES COUNCIL, Hammond, Ind. Henry Gabler, Secretary, 436 Sumner st., Hammond, Ind.

Aug. 30-Sept. 1—MICHIGAN STATE GOOD ROADS ASSOCIATION. Annual meeting. Flint, Mich.

Sept. 6-10—INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS. Colorado Springs, Colo. Secretary, C. R. George, Houston, Texas.

Sept. 12-26 — AMERICAN INSTITUTE OF MINING AND METALLURGICAL ENGINEERS. Wilkesbarre, Pa.

Sept. 13-16—NEW ENGLAND WATER WORKS ASSOCIATION. 39th annual convention. Bridgeport, Conn. Secretary, Frank J. Gifford, 715 Tremont Temple, Boston, Mass.

Sept. 19-21—ROADMASTERS' AND MAINTENANCE OF WAY ASSOCIATION OF AMERICA. Chicago, Ill. Secretary, P. J. McAndrews, C. & N. W. Ry., Sterling, Ill.

September 19-24 — ASSOCIATION OF IRON AND STEEL ENGINEERS, La Salle Hotel, Chicago, Ill.

Sept. 26-30—ILLUMINATING ENGINEERING SOCIETY. Rochester, N. Y. Illuminating Engineering Society, Chicago Section, Chicago with National.

Sept. 28 (10 days)—NEW YORK ELECTRICAL EXPOSITION. Seventy-first Regiment Armory, New York City.

October—IOWA SECTION OF THE AMERICAN WATER WORKS ASSOCIATION. Seventh annual meeting, Omaha, Neb. Secretary, Jack J. Hinman, Jr., State University, Iowa City, Ia.

Oct. 5-7—SOCIETY OF INDUSTRIAL ENGINEERS. National convention. Springfield, Mass.

Oct. 1-15—LYONS FAIR FOR PROMOTION OF INTERNATIONAL TRADE. Lyons, France.

Oct. 11-14—INTERNATIONAL ASSOCIATION OF FIRE ENGINEERS. Annual Convention, Atlanta, Ga. Hotel Ansley. Secretary, James J. Mulcahey, Municipal Building, Denver, Colo.

Oct. 24-28—AMERICAN SOCIETY FOR MUNICIPAL IMPROVEMENTS. Annual convention. Southern Hotel, Baltimore, Md. Secretary, Charles Carroll Brown, Valparaiso, Ind.

Oct. 31-Nov. 5—NEW ENGLAND ASSOCIATION OF COMMERCIAL ENGINEERS. Power show in connection with INTERNATIONAL TEXTILE EXPOSITION. Mechanics' Building, Boston, Mass. Secretary, James F. Morgan, Devonshire st., Boston.

Nov. 14-18—AMERICAN PUBLIC HEALTH ASSOCIATION. Annual meeting. New York City.

AMERICAN ENGINEERING COUNCIL

The next meeting of the executive board of the American Engineering Council of the Federated American Engineering Societies will be held at the Cosmos Club, Washington, on September 30. The most important business coming before this meeting will be the election of a president to succeed Herbert Hoover, who resigned after he became Secretary of Commerce. Special attention will be given the plans for the Engineering Assembly, extension of Employment Service, question of licensing and registration of engineers.

The engineering assembly committee has been appointed with A. P. Davis as chairman. Present plans are to make this assembly a three days' session, starting between the middle and latter part of January. In general, one day will be given to special meetings of the executive boards of member organizations and committees of the American Engineering Council. One day will be given to the sessions of the American Engineering Council and at least one day will be given to the discussion of some special topics such as elimination of waste, licensing of engineers, the national department of public works or some other subject of equal importance to the engineering profession.

On the question of licensing of engineers it is contemplated that council's licensing committee will be able to submit a complete report to the board. Licensing had become such a very important subject with engineers that the executive board instructed its committee to proceed with hearings on this subject as a basis for further reviewing and changing the model licensing law. It is contemplated that the Committee on Classification of Engineers will report its recommendations to the council at the next meeting.

THE CONNECTICUT SOCIETY OF CIVIL ENGINEERS

The annual summer outing was held August 9, at Double Beach, Conn., on Long Island Sound, about 9 miles from New Haven, whence the members and guests journeyed by automobiles. There was a baseball game between Hartford and New Haven teams, swimming and running races, and other sports, and a shore dinner was served. A short business meeting was held at which new members were elected.

PERSONALS

Briggs, B. A., is now with the Colorado State Highway Department.

Morse, W. C., has opened offices in Seattle, Wash., where he will engage in general engineering-contracting work.

Shaw, Arthur M., will superintend the design and construction of a complete sanitary sewer in San Pedro, Sula, Honduras, C. A.

Bogard, Noah, of Washington, Ind., died July 18 of heart trouble at Olney, Ill.

Smith, Herschel C., has been appointed assistant professor of highway engineering and highway transport at the University of Michigan.

McGrath, J. K., is now division engineer with the West Virginia State Highway Department.

Briggs, B. A., is now connected with the Colorado State Highway Department.

Stringfellow is a new member of the Alabama State Highway Commission.

Limerich, R. C., has been appointed state highway engineer of Arkansas.

Middleton, Ellis G., is now with the West Virginia State Highway Department

Pridgen, J. B., has been appointed engineer in charge of construction by the North Carolina State Highway Commission.

McCluskey, Jr., W. J., has been appointed assistant division engineer by the West Virginia State Highway Department.

Spooner, W. C., has been appointed superintendent of highways of Duval county, Fla.

Ross, F. E., has been appointed city engineer of Jefferson City, Mo.

Dambach, W. N., is now with the Carlem Engineering Co., Pittsburgh, Pa., in the capacity of vice-president.

Sims, Frank F., has opened offices for the practice of industrial engineering at 1306 L. C. Smith building, Seattle, Wash.

Downie, R. W., has been appointed tester of building materials for the Welland Ship Canal at Merritton, Ont.

Crocker, Herbert S., has reopened his office in Denver, Colo.

W. J. Young has been made chief engineer of the Standard Lime & Stone Co., and of the Washington Lime Co., of Baltimore, Md.

Reid & Milford have opened a new office at Fourth street and Western avenue, Los Angeles, Cal.

Edgar T. Wheeler now has his offices at 402 Los Angeles Railway building, Los Angeles, Cal.

Gillespie, Richard H., died at White Lake, N. Y., on July 15.

Knodel, E. C., died July 15 in Atlanta, Ga.

Andrews, John S., of Seattle, Wash., died July 17 at the age of fifty.

Oliveras, Adolpho, died in Santa Monica, Cal., at the age of sixty-six years, on July 3.

Hanson. Joseph. died in Tacoma, Wash., recently.

INDUSTRIAL NOTES

The Bingen Brick Manufacturing Co., Bethlehem, Pa., has been incorporated with Mahlon Ritter at its head.

G. J. Fink is now on the technical staff of the chemical department of the National Lime Association, Washington, D. C.

The Allied Machinery Co. of America, 51 Chambers street, New York City, has been appointed foreign representative for the Universal Crane Co., Cleveland, Ohio.

The Elcon Engineering Co. has opened offices in Columbus, Ohio, and will engage in general contracting and engineering, specializing in elevating and conveying equipment.

The firm of Batchelder & Scales has been organized at 35 West 27th street, Indianapolis, Ind., for the purpose of conducting a general architectural and structural engineering business.

Norman J. Warren has been appointed general manager for the Dominion Bridge Co., Ltd., and will have his headquarters at Montreal.

E. W. Verity, Jr., has been appointed construction manager with headquarters in New York City, for Admiral & Co. Carl H. Sanbord was made New England representative with headquarters in Boston, Mass.

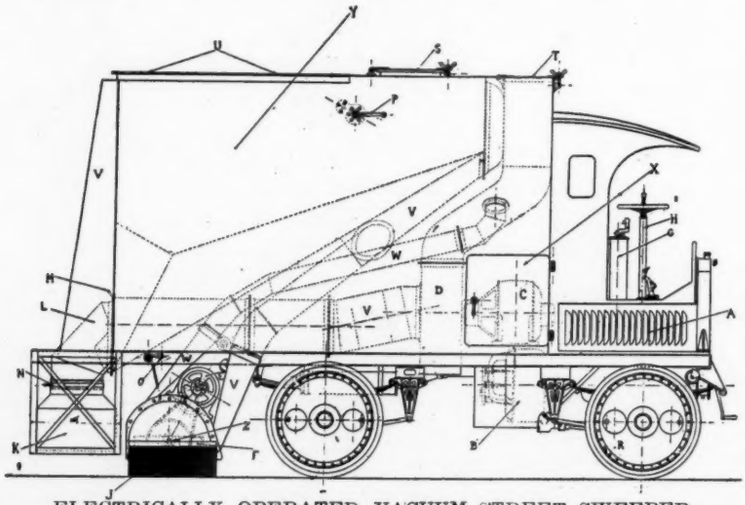
New Appliances

Describing New Machinery, Apparatus, Materials and Methods and Recent Interesting Installations

ELECTRIC VACUUM STREET SWEEPER

The Ohio Municipal Equipment Co., after several years' experimenting, has developed a machine that is now being offered to municipalities in two standard sizes, viz., of 8-foot 6-inch and 4-foot 6-inch sweeping widths.

All operations are by electricity, which is generated on the machine, this including power to propel the machine, operate the exhausters and manipulate the revolving brush. There is a separately controlled motor for each service, so that the suction at the point of pick-up and pressure at the back of the brush, which are created by the exhauster, can be regulated to suit the condition of the street, as can also the speed of revolution of the brush.



ELECTRICALLY OPERATED VACUUM STREET SWEEPER

The points of advantage claimed for this sweeper are:

It works rapidly and without dust.

Street sprinkling and flushing are entirely eliminated.

No dirt or refuse is handled by the exhauster.

The machine does not dump dirt on the streets or visit the dump.

It sweeps at 3 to 5 miles an hour and travels 12 to 15 miles to and from the working area.

It is quiet in operation, handsome in appearance, sanitary and hygienic.

The streets of Columbus, O., are being swept with it every day and demonstrations have been made in neighboring towns.

Operating Costs—Based on a $14,000 list price of an 8-foot 6-inch sweeper, machine operating 5 miles per hour, 16 hours a day, and gasoline at 31 cents per gallon, the costs are figured as follows:

1 Driver at $4.50 per day of 8 hours	$4.50
2 Helpers at $3.50 per day of 8 hours	7.00
Gas consumption, based on 5 mi. per gal. of gasoline at 31 cents per gallon	2.40
Oil based on consumption of 400 mi. per gal. of oil	.10
Tires, 2c. per mile	.80
Repairs, 2c. per mile	.80
Interest on list price of $14,000 at 5%, assuming 300 working days of 16 hours per day; for 8 days	1.16
Depreciation, 10% on $14,000 assuming 300 working days of 16 hours	2.33
Brush renewals, assuming 1 fibre brush lasts 96 hours—12 days of 8 hours	2.00
Cost per 8 hours work, total	$21.17

Area swept in 8 hours, assuming 5 miles per hour and 8 ft. 6 in. sweeping width, area cleaned in 8 hours=approximately 200,000 sq. yds.

Cost per 1,000 sq. yds. cleaned

$$= \frac{200{,}000}{1{,}000} = 200 \text{ costing } \$21.17$$

10 2/3 c. per 1,000 sq. yds. cleaned.

Description of Machine—Chassis, built under license of Church Balance Gear Co. Electric power plant comprises internal combustion motor direct coupled to specially designed dynamo, carried at front end of chassis. The propelling motors are built into the disc steel wheels and thus totally protected from dust and water. The controller is mounted in a position convenient for the driver and all control meters are in his view. All parts of driving mechanism and controls are accessible for adjustment and repairs.

The brush and pick-up mechanism are placed behind the rear wheels. The brush can be removed and replaced without dismantling any other units of the chassis.

All the street refuse is collected in the large separator and then gravitates to the removeable containers at the rear of the machine, which are removed when full and replaced with empty ones without stopping the machine.

The accompanying diagram of the machine shows clearly its construction and operation.

Description of Parts

A. Internal combustion gasoline motor generates power for all motors.
B. Electric generator.
C. Electric motor driving exhauster.
D. Exhauster.
E. Electric motor driving brush.
F. Vertical revolving brush.
G. Electric controller.
H. Steering wheel pillar.
J. Flexible flange around brush casing.
K. Removable container.
L. Refuse outlet pipe.
M. Outlet pipe valve.
N. Clamping device for containers.
O. Handle for brush lifting mechanism.
P. Handle for screen agitator.
R. Motor equipped driving wheels.
S. Man hole to separator chamber.
T. Inspection cover for outlet from exhauster screen.
U. Flange of removable screen.
V. Suction and intake pipes to separator and exhauster.
W. Blow pipes to brush casing.
X. Door to spare container receptacle.
Y. Main separator.
Z. Main revolving brush.

The Orangeville Brick & Shale Products Co., Orangeville, Ohio, has been incorporated for the purpose of brick manufacture.

Clarence V. Brown has been appointed receiver of the Universal Utilities Corporation at Alpena, Mich.

J. S. Molloy is the mill manager of the Centerville Gypsum Co., Centerville, Iowa

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Fred M. Randall has been elected president of the National Cement Co., of Detroit, Mich.

F. E. L. Whitesell has been appointed New England representative of the Railway & Industrial Engineering Co.

Wills, Bill & Co. will carry on the business of Wills, Ludwick & Co., 1700 Sansom street, Philadelphia, Pa.

William J. Reintjes has his office at 1517 Commerce building, Kansas City, Mo.

The Badger Concrete Mixer Co. will have a new factory at Winthrop Harbor, Ill., just north of Chicago.

The Barrett Company are now occupying their new offices at 40 Rector street, New York City.

The Heltzel Steel Form & Iron Company, of Warren, Ohio, has acquired the services of J. D. Ackenheil, formerly connected with the Portland Cement Association as field engineer, Pittsburgh district.

Mr. Ackenheil has had considerable experience along the line of road building in promotional and constructive capacity, having had supervising charge of a number of important highways. The subject of steel forms has been one of his studies from a constructive viewpoint, during his four years' service with the association, and he is, therefore, well fitted to advise and confer with contractors and engineers as to forms and other details of highway construction.